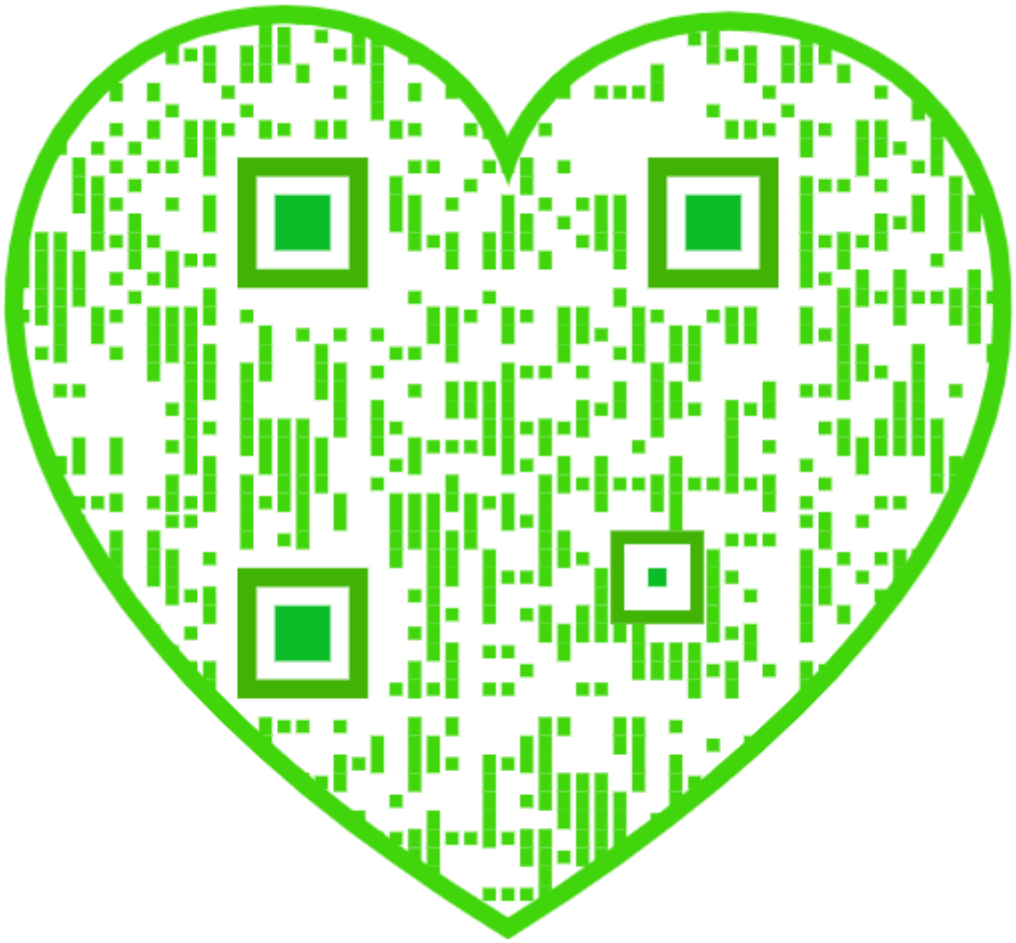

NEW

ASTRONOMY,

BY

P. E. TRASTOUR, M. D.

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EXPLANATIONS.

Zodiac.—The zodiac is an immense belt, or circle, which surrounds our sky. It is composed of two bands, each band being about eight degrees in width. The elliptic is situated between these two bands. The zodiacal circle circumscribes and embraces within it all the annual orbits of the planetary bodies of our system. It is divided into twelve signs, succeeding one another in the following order:

1. Aries.
2. Taurus.
3. Gemini.
4. Cancer.
5. Leo.
6. Virgo.
7. Libra.
8. Scorpio.
9. Sagittarius.
10. Capricornus.
11. Aquarius.
12. Pisces.

Each sign is divided into 30 degrees, consequently the entire circle of the zodiac contains 360 degrees. Each degree is composed of 60 minutes, and each minute is divided into 60 seconds.

The invention of the zodiac dates from the remotest antiquity, and is lost in the night of ages.

Ecliptic.—The ecliptic is an immense circular plane, which the sun, the earth, the other planets and the satellites of our planetary system, travel over in their annual revolutions.

Apogee is the point where our earth is at the greatest distance of the sun.

Perigee is the point where our earth is the nearest to the sun.

° signifies degree, ′ minute, ″ second.

99 degrees, 39 minutes, 22 seconds, are written so: 99° 39′ 22″.

PREFACE.

THE origin of Astronomy goes back to an obscure period, very anterior to the ages, that we call ante-historical. Till *that* day, all the scientific data has been unable to carry us further back than ancient Egyptian Astronomy. Nevertheless, the antique Astronomy of the Egyptian priests shows such considerable developments, that they make us infer many astronomical periods, of a long priority. Besides, the state of the Egyptian acquirements do not correspond with a primordial state. We must, then, sail down the stream of numerous centuries, before reaching the time, in which we can suppose Astronomy began to appear in old Egypt; and that time is itself a far back remote period.

In the sacred colleges of Egypt, the study of the heavens was the object of a strong meditation, and of a scrupulous and constant practice. The ambition of the members of those sacerdotal institutes, at once priests and astronomers, incited by the ignorance of a superstitious people, quickly intimated to them the certainty of making themselves the absolute masters of human conscience, in introducing their science into the mysteries of divine worship; and with that intent, they were obliged, first of all, to captivate the national understanding. They could do it. It is by the precision and strictness of their astronomical method, that they secured for themselves an authority, which grew up into one of the most absolute that human tyranny has ever exercised. The national spirit was dazzled to such a degree, that it

could not understand, nor even doubt, respecting the supernatural power of their priests.

Everything was experimental and not speculative in their science. That forecast was dictated to them by the fascination, of which they had foreseen the necessity of surrounding their persons. Everything to them ought to be infallible. Their experience had taught them to take heed not to make any systematic speculation, but confine themselves strictly to the acquirement of the movements of the celestial bodies. They succeed in announcing the return of the heavenly phenomena with such a perfectness, that in Egypt, nobody doubted that an extraordinary power had been transferred to them by the divinity, with which they had insinuated they had connexions. That general belief put into their hands an unlimited power and the riches of the nation.

Their oppression underwent different turns of a mischievous fortune, until the time when Cambyses governed that country by right of conquest. Under his rule, the institutions of the ancient Egyptian worship disappeared. The sacerdotal caste was massacred. Nothing was left of the ancient science but a few remnants, scattered here and there. It is deeply to be regretted, that up to the present day, notwithstanding all our researches, we have never been able to form an exact idea of the elements of that antique science.

The revival of Astronomy in Egypt, brings us to an age less distant from our own. After the death of Alexander the Great, that country fell to the lot of Ptolemy Soteres, one of the generals who had served under him. Ptolemy Philadelphus, his son and successor, founded an academy at Alexandria, to which the most distinguished philosophers of Greece, gave, then, a world-wide celebrity. But, it is necessary not to confound the doctrine of that comparatively new school with the antique astronomy of the ancient Egyptian priests, the principles of which are lost in the obscurity of a remote past, dimly defined.

The population of Alexandria was composed, at that time,

of Greeks, Egyptians and Jews. The perpetual contact facilitated the fusion of the ideas. The Greek race was prevailing, not in number, but by intelligence. Alexandria was the rendezvous of the learned men and philosophers of all the countries.

The Alexandria School viewed the mechanism of our planetary system with eyes of imagination, and gave birth to a system impossible to be reconciled with the celestial movements. The middle ages having found it agreeing with their creed, accepted it with closed eyes, as an auxiliary which ought to be subservient to the demonstration of their theology, and uphold it with the thunder of the church and terror of the holy office. So, error continued its tyrannical usurpation over a posterity of forty-six generations.

The long duration of its sway had secured for it, the prestige of time that which its teaching had sanctioned. At that age the philosophy was called the maid-servant of theology. The faith which had been placed in this doctrine, was eagerly brought forward as a most powerful argument against the innovation, or more properly speaking, the renovation of Copernicus, at the time when the latter appeared.

This renovation was but a return to the chimera of Pythagoras, an odd dreamer, whom the numbers had half demented. The doctrine of Copernicus, which the forgetfulness of a remote past, then, kept in the obscurity of tradition, is, at the present day, carefully surrounded by watchful guardians. The academies have constituted themselves its safeguards. They do not permit neither investigation, nor contradiction about it. It is a sort of anti-scientific interdict.

While time has been the great maker of human science, modern experience has been enlightened by a knowledge more complete of the world, making use of science's power, in order to bring the extinction of poverty happily about. Man is able, in fact, by science to give to his progress a select and required direction. Bacon has been the principal

organ of civilization by science. The utter deficiency in scientific culture, is the slavery of the conscience, the superstition and abjection. It is sufficient to visit the populations debased by ignorance, in order to be convinced of that striking truth.

The physiologists have stated that the qualities, acquired during several generations, ended by being transmitted with the blood, and by passing to the state of instinct. The characteristic state of features announces to the physiognomist, the brutishness or the elevation of the mind. If some generations turned their intellectual movements towards the science, their faculties would arrive to a regeneration of a decided superiority, and the body would improve in beauty. That mighty sovereign, in filling the thought with its grandeur, would make to them a habit of its dignity, of which the nobleness should be reflected on the physiognomy.

But, so long as men who rule society, and families which form it, are hostile to the progress, and continue to compound with the passions, roused by usurped interests, through fear or ambition, indigence will shut the doors of the teaching to the most numerous class, and will maintain them in the incapability of getting free from the slavery of the senses and of the imagination ; such is the destiny that our social organization tends to make to the destitute.

The destiny of man, of animal and plant, is determined by an irrevocable law. But man has more than the animal and plant—a social destiny.

Man, on his first entrance into life, brings with him his destiny, good or bad; an invisible inherence, fastened to his individuality, and only known by its effects, which is susceptible neither of becoming more, nor of becoming less; which remains inflexibly what it is, and by which he is entirely mastered during his own life. The prayer and cry of the distressed soul, asking for a less stern condition, is before the destiny no more than a mere word, thrown to the winds. It would be the same as to ask for a different size, or another

feature. What a prayer to be offered up to the immutable, and consequently to the inexorable! Any sort of prayer, any religious observance, any offering made to the Church or to the churchman, cannot diminish the malignity of a bad destiny, to the accomplishment of which man is driven by the earth's fatal forces, of which the power exceeds his own. Whether you go to the church or not, your destiny remains irrevocably the same. We have consulted old men, completely destituted, in different times and in different places. Every one of them declared to have prayed his entire life, and to have been always overwhelmed with evils. Experience has ascertained these facts, against which the contestation is no more possible to the serious minds who seek only for truth. Every link interwoven in the entire chain of beings has been fixed forever by the law of nature, of which the proper character is an absolute and universal immutability.

If nothing can prevail against the destiny made to us by nature, we possess the faculty of redressing the destiny which originates in social causes. But a happy social destiny can be only the work of civilization, and this work of progress will be fulfilled when humanity enters into the years of his manhood. It is, in fact, civilization alone which can put a term to our weakness and faintnesses which still humble our time.

The civilization, in giving to our moral faculties the strength, the health and the continence, will make and penetrate into the heart of the social man a feeling of union in the common efforts to maintain a salutary respect for the law, and to human dignity as much as to the rights of the citizens, and, by progressive series of modifications, will identify the people with the practice of good, of labor and honor.

Then may we not only lessen a bad social destiny, but to extirpate it from society will lie in the power of humanity, and even from this moment the social destiny leaves to us the option of our proccedings. But a first choice carries along a

succession of unavoidable consequences. The option made by the ignorance, influenced by the imagination, is commonly fatal to itself. The ignorance is the man turning the mill, assimilated to the beast of burden; it is the conscience, led here and there by imaginary fears, robbed of his money by means of gross deceptions, enslaved by preconcerted untruths of the ambitious castes, and blasted with abjection. Even the reason without science is incapable. However admirable that faculty may be made, it is given to us, by all the possible ideas, by the experience of the senses. So all that we know is the result of comparison of sensible things which surround us.

Science, in cutting away ignorance and error, tends by its light to make humanity master of truth, and to suppress indigence and maladies, by shedding it over mankind. But if we were comprising under the name of humanity the immense majority of the half barbarous populations which occupy the most extended part of our globe, we would be obliged to look at the future as an illusive expectation. Let us notice here that science expands only in its sphere of activity, into which have entered these great nations that we call the United States, France, England, Germany and Italy. Science cannot see the destiny of humanity elsewhere; and, however, still now, in the midst of these enlightened countries, what a large share we must give to the unintelligent multitude! There, the class in which the thought and science reign forms an imperceptible minority, and the class of the ignorant, in which the superstitious barbarism of the imagination resists the knowledge of our age, is in an immense majority. Imagination, that atrocious companion of man which forsakes him but very seldom, is what has done the most ill turns to him. It is the cause of the greatest disasters which have crushed the individuals and families, and of all the griefs and crimes which have dishonored the earth. The knaves of every sort, looking for cozen, apply to the imagination.

That picture would be fit for taking from us all hope of a better time, if we may not know by the examples of the past that it is the very small minority which forms the class of the cultivated thoughts, to which is always bestowed the initiative of the movements which transform the world. In despite of the enemies of knowledge, who dry up the good germs of civilization, and of resistance of all usurpations, the science passes with serenity over those impediments, fully convinced there will come a day in which the social well-being of each one and everybody will be realized by means of a progressive series of improvements.

CHAPTER I.

SYSTEMS OF PTOLEMY, OF COPERNICUS, OF TYCHO-BRAHE, KEPLER'S LAWS, NEWTON'S THEORY.

MATTER is eternal, immutable, universal and infinite; its laws are alike unchangeable, universal and eternal, because they are no more than the properties of its intimate essence. Matter and its laws are inseparable and maintain eternally their same connections. They can not perish no more than change. Their immortality became a positive truth, since the modern discoveries of chemistry. When, in the study of nature, it is looked at the bottom of things with an absolute independence of the impressions of the exterior life, such as prejudices, party spirit, the self-interest and all passion hostile to the reality of things, what fixes seriously our attention, is the constant stability of these laws which are inherent to the constitutive essence of matter. There is the wherefore, nature does not permit miracle in its domain. For, in order that a miracle might happen, it would be necessary to annihilate before all that exists, matter and worlds, and to create a new matter, provided with new properties, suited for the required miracle; and this would be done for every new miracle thought needful. The indefectibility of the universal laws, proves the impossibility and nothingness of the miracle. The sav-

age hordes, the ignorant populations of the mountains, see miracles; the enlightened people, the centres of civilization do not see any. The experimental observation of a positive science, shows the real existence of that principle of the matter's immutability, so little accessible to the comprehension of families, to whom the imaginative intelligence, has taken away the liberty of thought, or has imprisoned it in feelings, inspired by illusions and chimeras. The intelligences over whom the imagination has dominion, set a striking example of incapacity to the power of observing.

Let us at this point of view and before exposing our planetary system, cast a glance over the conditions of what exists on the earth's surface, and it will be followed by some rapid considerations about the teaching of astronomy, that has been made in the preceding times.

An unceasing progress makes its work on the earth. Science of facts, against which it is not possible to reply, demonstrates peremptorily that every living type has not been constituted once forever. The progressive development of plants, animals and man, undergo transformations which improve them since their appearance on our globe. These transformations are brought about obscurely, imperceptibly and slowly; but, if they are slow, they are unceasing. If the organs in man are admirable, they are but unfinished; nothing in him is definite. However, man of our days, is not to be compared with the primitive man, of whom the normal state was a savage state. Human craniums found pell-mell with fossils of extinct animal species, show their anterior pieces, in which the intellectual organs reside with a hard bony thickness and soldered together. All further

increase of the brain, and in particular of the gray matter, was then impossible. Such a cause of incapacity is not seen, to-day, in the white race.

The apparition of man is considerably prior to Genesis; he was present at the geological evolutions which preceded the actual state of the continents. Numerous thousands of years have been necessary to bring man out of the miserable state in which he stood before holding his conscience, and which made him take a decisive superiority over his abject past. For, in his primitive state, incessantly occupied with his subsistence, he lived after the manner of the beasts, in a continual activity, that the sleep alone interrupted. If his fear before the unknown, drove him to make his gods with the natural phenomena which terrified him, and to which he was making human sacrifices, he found also phenomena which charmed him. These were his household gods.

Thus, from that period of the world, in which man lived in the midst of a nature as savage as himself, if we seek to arrive at the period, when a beginning of progress left to him a time for the contemplative life, we must get down a long flow of ages. But, even then, the notions we have concerning the gradual development of mankind, are no more than an imperceptible portion of his true history. It is a very long while after having reached a much more advanced state of reflection, that man thought of couching his history in writing. History is the youngest among the branches of science; it goes back not beyond five thousand years, while observation dates far back to an obscure antiquity. But, observation has never answered satisfactorily to the call of science.

In the academy, at Alexandria, its philosophers were

engaged in all manner of observations, and nevertheless the imagination furnished the basis of all their deductions. The reality of things was wanting in their erudition, and science remained in its infancy. Such a past teaches us that observation, left to its own resources, most generally, cannot escape the confusion of the ideal and the real world. In fact, observation can only aver the phenomena, such as nature shows them, involved in the accessory incidents which misrepresent their law. It has been indispensable, in our modern times, that experimentation, accepting the observation for what it is really worth, reached the bottom of the phenomena in order to improve some branches of science, as we see them in our days.

The experimentation introduced in science by chemistry and physics, which has pushed them on the progress to a high degree. Both, at the present time, are very precious for the comfort of life, and of a great utility for the arts and industry. The astronomy has not taken so good an example. The speculative theories obstruct still its way.

We cannot, indeed, assimilate for the method of experimentation, astronomy to chemistry. But, if chemistry has its crucible and its re-agents of analysis, astronomy has its instruments of precision and its special method of experimentation. The experimentator-astronomer can investigate the celestial phenomena, under all their aspects, and make them pass through series of combinations which will allow him to distinguish what truly belongs from what does not belong to them. His proceedings must assume the most penetrating criticism, which will bring him to eliminate the foreign accessories and keep up the reality. It is, in separating what

is true from what is deceptive, that he shall be able to disengage from all delusive exterior the elementary facts, and to lead them to their decisive simplicity, so that their property can be seen undeniable. And, yet, that condition is not sufficient for the exigencies of astronomy. After having found the law sought for, it must be referred practicably to the celestial movements, and if it agrees with them, without any effort, but easily, directly and with a clear precision, whatever manner it be applied, it is, then, no more doubted that its requested reality is shown by the light of evidence.

Simplicity and might are traits the most eminently characteristic of nature, and by their simultaneousness are a constant protest against our methods of mathematical interpretation. Abstruse formulas have not yet attained that degree of perfection which they are to expect from its teachings. But, such is the deductive force of prepossession, that we have abandoned to these formulas, the guidance of our intelligence so far as to bestow upon the prestige which they derive from our credulity, the power of abusing it. Time, however, which in no wise shapes itself to suit our ways of thinking, has not failed to belie the results of their indications, while it has, on the other hand, consecrated the knowledge arising from experimental observation.

Abstruse formulas are the counterpart of those wearisome controversies, which, in the days of Aristotelianism, scholastic pride took glory in prolonging for several hours at a time. Long displays of arguments were, then, held in high esteem. Circumstances having become changed, the turn of ideas took another direction, and by contrary excess, all those questions, which ordinary language could treat in a satisfactory manner, are

now discussed by means of formulas which have become remarkable for the affectation and emptiness of their exaggerated brevity. These phraseologies, made up of signs and words closely packed together by an artful conventional contrivance, are better known to the majority of readers for their unintelligibility, rather than for any advantage which has been derived from them.

Thanks to this equivocal argumentation, which favors all and any speculation, the system of Copernicus, brought itself into such repute as to be viewed only through the eyes of faith, though it may have not a single proof of its existence.

Modern astronomy don't understand even the doubt about the hypothesis of Copernicus, who places the sun in the centre of the planetary system, and makes the earth and the other planets revolve annually around that luminary. But, since the Kepler's laws were known, the astronomers, while maintaining the doctrine of Copernicus, concluded with a remarkable unanimity, that the orbits of the earth and planets, were no circles but ellipses. Their abstruse formulas and analytical researches have had no other aim than to represent the mechanism of the planetary system, so understood, as a truth henceforward unquestionable, viz: "*that the planets revolve round the sun in the elliptical orbits of which that luminary occupies the common focus.*" This system is now universally acknowledged without any contestation. One must have robust faith, indeed, to believe that ellipsis obtains, in the heavens, properties that it could not have on earth.

The question is for us, neither to attack nor to uphold that system by a mere spirit of prepossession, but to seek for the reality without our mind made up in no

wise, and without inclining our head before the decisions of any authority, whoever this one may be. Our object is to take the language of facts for umpire. Thus, it is only necessary to trace the system of Copernicus back to its source, in order to become convinced, that it originated from a tradition of chimeras.

But, first, we will look rapidly at the system of Ptolemy. It was the opinion of the philosophers of Alexandria, which gave birth to the false conception of the sun and of the stars revolving daily around the earth. Its most glaring defect, the impossible rapidity with which it was necessary to suppose the sun and chiefly the stars to be possessed in order to circulate each day around the earth, had the power neither to undeceive the wisest men of the time, nor to check the tyrannical domination of that doctrine during 2,000 years. It finally yielded its place to the system of Copernicus.

In 1507, the epoch in which Copernicus began to meditate upon the system of Ptolemy, fifteen years had elapsed, since the discovery of Christopher Columbus had revived the geographical studies. This revival was a necessity, prescribed by the pressing difficulties of the moment, and answered, then, in some respects, the ambitious views of the adventurous speculations of the time. Stimulated by the exaggerations which fame had brought from remote countries, reports, in passing from mouth to mouth, extolled still more all that heated imagination, according to its inventive powers, could fancy touching those regions, as yet shrouded in mystery. The ocean had not given the secret of its trackless paths, and public curiosity, welcoming every account, endeavored to probe for the truth which was wanting on all sides.

The thirst of riches did not cease to create new expectations, and astronomy, in allowing the importance of its aid to be perceived, received great eclat from the interpretations that were set to its credit. It is not to be wondered at, that these united causes should have influenced the decision of Copernicus, to whom the defects of the Ptolemaic system afforded the opportunity of striking a new route for himself.

Copernicus had read that Nicetas of Syracuse had taught that the earth revolved upon its axis, and that the doctrine followed by the Pythagorean school, placed the sun motionless in the centre of the universe, and caused the earth and the planets to revolve around that luminary.

Another system which he had found in the writings of the ancients, had equally struck him. This latter supposed Mercurius and Venus to circulate round the sun, and caused that luminary, Mars, Jupiter and Saturn to revolve round the earth.

His mind became divided between these two doctrines; he left time to decide what, in the moment, he had not the spirit to determine, which caused him to waver thirty-five years between the two opinions. At last, weary of having read over, meditated and often delayed, he finally adopted the old Pythagorician idea of the immobility of the sun in the centre of the system, and of the circulation of the earth and planets around that luminary. It is this system which bears his name and which is prevailing now.

Under the influence of similar aspirations, Tycho-Brahe thought it due his reputation to venture an astronomical system.

Although his work was that of the first observer of

his age, the oddity of its arrangement is shocking. The ideas which prevailed in his time, caused him to imagine a system, destined to conciliate his religious and astronomical beliefs. Hence the immobility which he gives to the earth and the motion which he supposed the planets to describe round the sun, while that luminary circulated with its whole train of attending planets, round our globe. The system of Tycho-Brahe ended as generally ends a doctrine of a too visible deformity.

Kepler having joined his theory to the hypothesis of Copernicus, limited his observations to certain differences in the annual distances from the earth to the sun and to Mars. Having followed exclusively the movements of the latter planet, its alternate approaches and withdrawals caused him to imagine that it described an ellipse and not a circle. This illusion sufficed to induce him to establish his theory, in which the orbits of the planets were ellipses, of which the sun occupied the common focus. Astronomers have taken seriously the illusions of Kepler for the real movements of the planetary bodies, and hence has arisen a system that openly violates the laws of mechanics.

But, this is not all. An occult system of physics, repudiated by every truth of mathematics as forcibly as by good sense, viz: Newton's fantastic commentary of universal attraction, in which he did not himself believe, has become the standard text, that explains the irregularities of the planets, the inequalities of the moon, the precession of equinoxes, all of them, vain appearances without any reality, and moreover all the mistakes in reference to the alternate movements of dilation and contraction of the small axis of the elliptic orbit of the earth, which they say maintained in the slightly devel-

oped variations, reduce the variations of climate to very narrow limits.

The climates of the earth are, on the contrary, subject to extreme vicissitudes.

These imaginary properties materially attached to a fundamental principle, which is no more existent than them, having left the theory of Newton in an incomplete state, in reference to the explanation of the moving mathematics of the heavens, he tried to fill that blank by imagining: that the earth and the other planets had, originally, received a primitive impulse; that each of them possessed a centrifugal force, the tendency of which caused, at every instant, to recede from the sun: that this luminary had the power to retain them by a centripetal force, which drew them toward its centre; that, from the opposition of these two forces, acting in contrary directions, resulted the order which maintains the annual revolutions of the earth and of the planets, in elliptical orbits around the sun.

Let us see now the objection which is raised by the most elementary and most evident law of mechanics. The centrifugal and centripetal forces are two contrary forces. It is certain, therefore, that they can only act on condition of being unequal; for, were they equal, they would oppose an equal power to one another, and a state of rest resulting, consequently, the earth would cease to move; on the other hand, were they unequal, one of them would definitively gain an advantage over the other, and whichever of the two forces proved the strongest, the earth would either fall on the sun, or escape from its orbit, and wander, at random, far from that luminary.

Newton had so well foreseen this decisive objection

that he allowed the following words, (which we give here textually,) to escape him: "*The centripetal and centrifugal forces, being equal, would destroy the movement of heavenly bodies; unequal they would produce chaos, we must have recourse to the hand of God.*"

Such a recourse is the unrealizable consequence of the human imagination, since nature never allows a miracle in its domain. The introduction of the supernatural into science, is the destruction of science.

There is, in the sun and in the planets, neither centripetal nor centrifugal forces. The stars or suns, in advancing from west to east, cause our sun, the earth and all the planetary bodies, to advance in the same direction. Our globe had no need of any primitive impulse in order to be set in motion. If the sun came to be extinguished suddenly, the rotatory movement of the earth around its axis, would diminish gradually, until it stopped entirely, without causing any damage upon its surface; and if subsequently the sun recovered its power of emitting light, the earth would resume immediately its normal movement slowly and progressively.

Not only modern astronomy is unable to reconcile the orbits of to-day with those of past times, but even it does not know the length of our civil year. Its almanacs continue to give it the same length, although it augments, at each annual revolution, by a number of seconds, proportional to that by which the orbit of the earth increases. Never is there a year of duration equal to that of the one preceding or following it.

The diminution of the obliquity of the ecliptic, is an opinion now established among the astronomers, and they are convinced that a day will come, in which the ecliptic and equator blended together, the sun will de-

scribe the equator. Then, a prolonged spring will reign. That diminution of the ecliptical obliquity, and the consequences inferred from that false idea, are mere illusions.

Eratosthenes, Strabo and Ptolemy, in their day, saw the sun reflected, at the summer solstice, in the famous well of Sienna. That luminary, in our time, does not even touch the edge of the well. But, these alternate approaches and withdrawals of the sun which return in our great period, do not, in any manner prove the diminution of the obliquity of the ecliptic. If, now, the sun progressively draws nearer to the earth in summer, in the lapse of time, it will recede from it at that season, and again will be reflected in the well, on the day of the same solstice.

The most transcendent language of algebra, has no prevailing right over the experimental observation. It is whatever the opinion of him who employs it, chooses to make it. Laplace, almost the peer of Lagrange, and after him, the first mathematician of the age, has constructed his celestial mechanism, (mécanique céleste) in huge quarto volumes full of calculations most difficult to read. A work not of genius, but the colossal product of a mathematical intellect of the first order. We must crave pardon for thinking that observation, controlled by the experiment, will cause its pages to be erased by posterity astonished at our credulity.

CHAPTER II.

EXPOSITION OF THE MECHANISM OF THE PLANETARY SYSTEM.

THE sun, the earth, the other planets and the satellites advance in their orbits, each one, by a movement invariably uniform. But, if we compare their movements among themselves, it will be seen that they differ one from another, every planetary body having its own proper movement.

SEE CHART 1. The sun and the planets accomplish their annual revolutions, proceeding from west to east, around a common centre *A*, which we will call planetary centre.

This centre *A* is fixed and always stationary in the same place, but only with respect to the bodies of our planetary system, and not with reference to the endless universe. All moves in the infinite.

The earth describes a circle in its annual revolution, not around the planetary centre *A*, but around the point *B*, situated not far from *A*. We will call the point *B*, the centre of the terrestrial orbit.

This point *B* is not fixed. It describes a small circle *BCD* and *B*, around the planetary centre *A*, in a period composed of twenty-four thousand years. This number has been deduced from a formula, that the experimental observations, with the help of time, had made known to the antiquity.

More, here is an experimental observation, made in our time, which demonstrates, that the centre *B* of the earth's orbit, circulates around the centre *A*, in ratio of 54 seconds, each year. In 1810, the perihelion of the earth, (the point of the earth's orbit nearest to the sun,) was in the direction of Cancer, at 99 degrees, 39 minutes and 22 seconds, east of the sign of Aries; and the centre *B* of the terrestrial orbit was consequently in the direction of Capricornus, at 279 degrees, 39 minutes, 22 seconds.

Since then the perihelion and the centre *B* of the terrestrial orbit have advanced to the eastward. In 1865, the perihelion of the earth was at 100 degrees, 27 minutes, 58 seconds, and the centre *B* of the earth's orbit at 280 degrees, 27 minutes and 58 seconds.

The perihelion could not have advanced to eastward, if the centre *B* of the earth's orbit, on which this progression depends, had not advanced itself, 54 seconds by year, in the same direction around the planetary centre *A*.

As the centre *A* of the orbits of the sun and the planets, and centre *B* of the terrestrial orbit, occupy two different places in the space, it follows that the orbit of the earth is eccentric with the orbits of the sun and of the planets.

Owing to this eccentricity, the earth, in its annual revolution, approaches the sun and the planets, and recedes from them alternately.

The centre *B* of the terrestrial orbit is, at present, situated near to Capricornus. For this reason it is that we see the sun and the planets nearer to us, when they are in that sign of the zodiac.

The diameter of the sun, having been measured ex-

perimentally, the diameter of its disk was found to be larger at the winter solstice (1955 seconds), than at the summer solstice (1891 seconds), and still larger at the vernal equinox (1928 seconds), than at the autumnal equinox (1916 seconds). The sun can only appear larger to us, when nearer to the earth, and smaller, when farther from it. It becomes, therefore, evident that the earth describes a circle, the centre of which is nearer to the winter solstice (Capricornus), than the summer solstice (Cancer), and nearer to the vernal equinox (Aries), than to the autumnal equinox (Libra).

It is to direct experimental observation that we are indebted for our knowledge of the fact, that the sun and the earth move, in their annual translations, from west to east, according to the order of the zodiacal signs, and these two spheres are always in corresponding and diametrically opposite signs. When the sun is in Aries, the earth is in Libra; if the sun be entering Cancer, the earth will be entering Capricornus; if the sun be passing through Libra, the earth will be passing through Aries; in fine, as the sun reaches Capricornus, the earth reaches Cancer.

Let us now examine the order in which the globes of our planetary system are situated, commencing with the one nearest to the planetary centre *A*, viz: the Earth, Venus, Mercury, the Sun, Mars, Jupiter, Saturn, Uranus. Thus, the orbits of the globes of our planetary system circumscribe the orbit of the earth, which is the smallest of them.

But there is an astronomical fact which proves that the earth's orbit is the smallest one, and the nearest to the planetary centre *A*, among all the orbits of our planetary system.

When following the annual movements of the planets —the nearest as well as the farthest from our globe—all of them, without exception, are seen as if they stopped, and then proceeded backwards towards the west, in a direction contrary to the route they pursue. This false appearance is what will enable us to confirm what we have said, *that the orbits of all the planets of our system circumscribed that of the earth.*

If several steamers are executing circular evolutions on a lake—such as Lake Pontchartrain—around a centre, the one nearest to that centre will describe the smallest circle, and at certain contours of her route the other steamers, seen from her decks, will appear as if they receded and went backwards, although they did not cease to advance. This false appearance has received the name of retrogradation in astronomy. But from the decks of the steamers farthest from the centre, the one nearest to it and which describes the smallest circle will never be seen retrograding.

The planets Mars, Jupiter, Saturn and Uranus have received the name of superior planets. This appellation, which serves to designate the fact that they are always seen beyond the sun, indicates, in our system, that their orbits circumscribe the solar orbit.

And since neither Mercury nor Venus have ever been seen beyond the sun, but both have always been observed on the hither side of it, they have received the name of inferior planets.

The northern hemisphere of the earth points toward the sign of Cancer, while the southern hemisphere is inclined toward the sign of Capricornus. These two inclinations in opposite directions are an effect of the inclination of the earth's axis to the plane of the ecliptic.

We have said, in the beginning of this chapter, that the planetary centre *A*, contrarily to the centre *B* of the terrestrial orbit, never changes its position in reference to the orbits of the sun and of the planets. But, setting apart this fixedness relative to our planetary system, this centre *A* is borne along, with all its train of attendants—the sun and the planets, including our earth and the satellites—in interminable circumvolutions. The planetary centre *A* passes no more, in all the eternity, by the lieu of space, through which it will have passed once.

The stars or suns are subjected to a general movement that carries them from west to east. They are linked together by connections, the effects of which have a living force. It is because they advance annually, from west to east, by a certain number of seconds, that they cause our sun and all the planetary bodies to circulate in their orbits in the same direction. But the latter luminary causes the earth, the planets and the satellites to revolve around their own axis. Whatever side in which they may revolve round themselves, that is no matter, since they are obliged by an immense force, far superior to any other, to advance invariably from west to east.

The duration of the seasons, is unequal for each of them. The astronomers who have caused the earth to revolve around the sun, agreeably to the Copernician system, rendered the invention of the elliptical orbit (i. e., of an oval form,) a necessary one, so as to account for the alternate approach and withdrawal of the sun during the year.

But, in order to appreciate how unsatisfactorily this invention answered the purpose of astronomers, we will

suppose the orbit of the earth to be elliptical, and the sun to occupy one of its foci, as they say. Two lines intersecting each other at right angles, at that focus, would not divide the elliptical orbit into four arcs, the length of which would correspond with the different duration of the seasons. This explanation points out materially the defect. The elliptical invention having, thus, failed to solve the problem, astronomers had to resort to the further desperate necessity of accelerating the proper motion of the earth in some parts of the orbit, situated near the winter solstice, and making it more slow-going in the opposite points, situated near the summer solstice, so as to reconcile their elliptical orbit with the unequal duration of the seasons. This explanation, we repeat it, rests on a material impossibility, although firmly sustained by the modern astronomers. A globe of which the movement would not be constantly uniform, is non-existent, and cannot be, in our planetary system, because this variation would violate the law of the celestial mechanism, which nature has settled with an absolute and universal determinism. The length of every season can be only in accordance with the length of the arc, that the earth describes in its orbit during the duration of the corresponding season.

The sun is, in our planetary system, the dispenser of light and heat. It regulates the seasons and the climates.

THE SEASONS OF THE NORTHERN HEMISPHERE.

See Chart 2. *EE'* is the line of the equinoxes, *NN'* the line of solstices.

If we suppose an imaginary straight line, *EE'*, to be

drawn from the vernal to the autumnal equinox, and another, *NN'*, from the summer to the winter solstice, these two lines will intersect each other, at right angles, and will divide the zodiac into four equal parts, each consisting of three signs, and corresponding to one of the four seasons, which the sun will traverse successively, in the course of the year. As these two lines intersect each other at the planetary centre, *A*, it follows that the centre of the solar and of the planet's orbits, (except that of the earth,) and the centre of the zodiacal circle, coincide with the centre, *A*.

But, such is not the case with the earth. Owing to the place which the centre *B* of the earth's orbit occupies, the arcs described by our planet, in the four seasons, are unequal. The arc which it travels over in the spring (of the northern hemisphere,) is less than the arc that it traces in the summer, and larger than the arc that it follows in the autumn; the arc which it describes in the winter is the smallest of all.

This is the reason why our spring is not so long as summer and longer than autumn, and why winter is the shortest of all our seasons; the spring being composed of ninety-two days and a fraction, the summer of ninety-three days and a fraction, the autumn of eighty-nine days and a fraction, and the winter of eighty-eight days and a fraction.

It will be seen on *Chart* 2, that the relative proportions of the seasons agree with the length of the arcs, which the position of the centre, *B*, of the earth's orbit, causes our globe to describe annually.

When the sun is passing through the three signs, Aries, Taurus, Gemini, the earth is passing through the three signs, *Libra, Scorpio, Sagittarius*, and we have

spring in the northern hemisphere, (and autumn in the southern hemisphere,) both seasons being of equal duration.

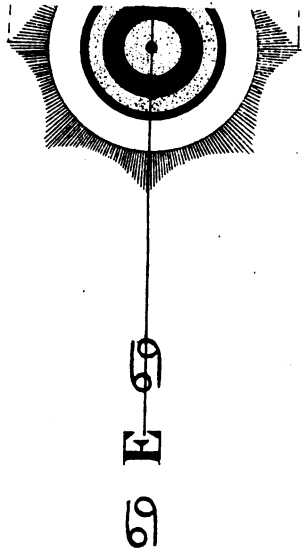
When the sun is describing the three signs, Cancer, Leo, Virgo, the earth is describing the three signs, *Capricornus, Aquarius, Pisces,* and we have summer in the northern hemisphere, (and winter in the southern hemisphere,) both seasons being of equal duration.

When the sun is traversing the three signs: Libra, Scorpio, Sagittarius, the earth is traversing the three signs: *Aries, Taurus, Gemini,* and we have autumn in the northern hemisphere, and (spring in the southern hemisphere,) both seasons being of equal duration.

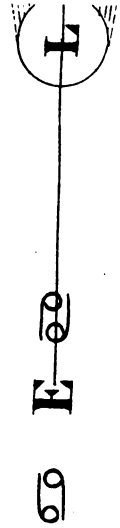
When the sun is making its way through the three signs: Capricornus, Aquarius, Pisces, the earth is crossing the three signs: *Cancer, Leo, Virgo,* and we have winter in the northern hemisphere and (summer, in the southern hemisphere) both seasons being of equal duration.

As we inhabit the northern hemisphere, and that the progressive development of humanity has taken place, from times immemorial, in that region of our globe, we have taken the habit of appropriating to the seasons of our hemisphere, the zodiacal signs which the sun is seen to describe during each of them. But, in a book on astronomy, the study of that science, must have in view the astronomical laws which govern the whole of our globe in its totality.

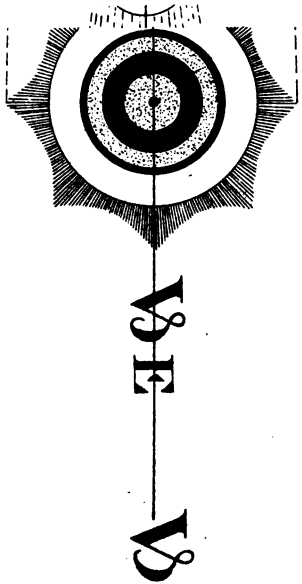
Should we examine attentively, the diametrically reversed order in which the seasons of the northern and southern hemispheres correspond to one another, it will be found that the inclination of the earth's axis is the



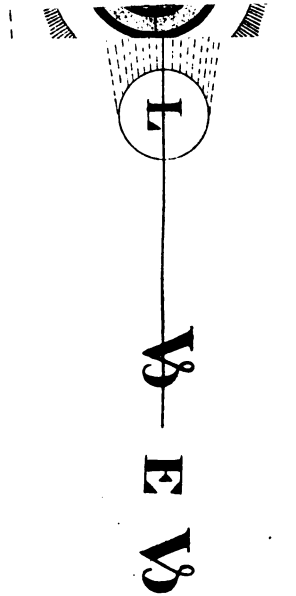
Cancer



Cancer



Capricornus



Capricornus

cause of the greatest and smallest repartition of heat upon both hemispheres in inverse ratio.

SEE CHART 3. *E E* is the line representing the plane of the ecliptic, seen sideway. *Fig.* 1. When the sun *S* enters the sign of Cancer, the northern hemisphere, which is inclined towards that sign, nearly faces our great luminary which, on that account, no longer sets for the inhabitants of the north pole *N*. It is, then, summer for the septentrional hemisphere. But the south pole *M*, being situated opposite and inclined towards the sign of Capricornus, is by that fact, deprived of the rays of the sun. It is, then, summer for the septentrional hemisphere. But the south pole *M*, being situated opposite and inclined towards the sign of Capricornus, is, by that fact, deprived of the rays of the sun. It is, then, winter for the inhabitants of the southern hemisphere. The full moon *L* sends always its brightness to the pole which is not lighted by the sun. *Fig.* 2. Six months later, the sun *S* arrives in the sign of Capricornus, and the southern hemisphere being inclined towards that sign, nearly faces, in its turn, the sun which no longer sets on the south pole *M*, and ceases to rise on the north pole *N*, which is in obscurity. It is, then, summer for the inhabitants of the southern hemisphere.

CHAPTER III.

THE PRECESSION OF THE EQUINOXES.

It has been observed that if at the vernal equinox the sun had covered a star of the ecliptic, that star would, 72 years later, be found on the same day one degree to the eastward. This phenomenon is called improperly by the modern astronomers the precession of the equinoxes. But in order that this result should present all desirable certitude, it must be made certain that a straight line drawn from the earth 72 years earlier would pass through the centre of the luminary, through the star, and through the planetary centre *A*. We will here quote the explanation which astronomers lay down to us as instruction:

"The orbit of the earth," they say, "is an ellipse which dilates in the sense of its smaller axis until it becomes almost circular. At this point, the movement of dilation becomes changed to a movement of contraction, and returns to its starting-point, to dilate anew in the same order, and so on in succession. During this time, the larger axis of the ellipse does not remain motionless. It displaces itself and causes the ellipse to pivot on its fulcrum, so that the same flattenings of the ellipse do not any longer correspond with the same positions of the larger axis, the proportions of which change with each revolution. The complicated play

of this mechanism is found to be in harmony with the ways of nature, because the earth describes its curve under the influence of the diverse globes of the planetary system which invite it in directions and at distances continually different. By the rotatory movement of the line of the equinoxes, the equinoctial points are displaced from east to west, and the plane of the orbit of the earth varies by lowering and rising alternately, accordingly as it obeys the movement which causes it to turn from west to east."

This explanation is refuted by itself, on account of the enormity of the complications and of the defect of movements of a material impossibility. Is it conceivable that *savants* could have imagined a so grossly improbable mechanism? Let us call to mind that they make the larger axis of the terrestrial ellipse of 70 millions, and the elliptical orbit of 540 millions of leagues. By virtue of what very powerful force they pivot with all their immensity on the fulcrum, and the earth passes, at each moment, from one plan to another, from one ellipse to a different ellipse?

That is what the astronomers call the precession of the equinoxes; but it is not, as they say, a movement of the equinoctial points from east to west. The erroneous conclusions that they have drawn do not proceed, as they believe it, from the movement of the equinoxes, which never change their place for another, since they are immutable. That phenomenon is caused by the anticipation of the terrestrial meridian over the sun, at each of their return to the same equinox.

It is certain that the sun, at each year, in passing the vernal equinox, always intersects, at the terrestrial equator, a point of some meridian whatever, which passes

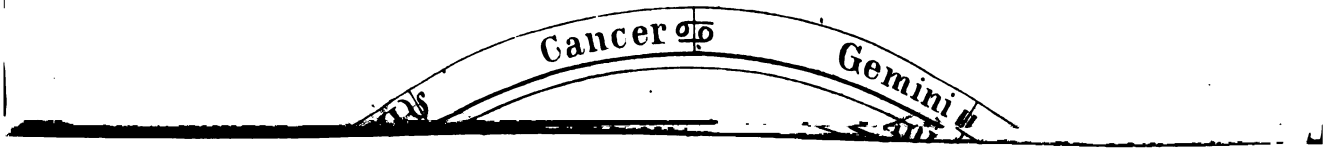
there at the time; and that, if this luminary, in a preceding year, had intersected, at the equator, the point *M* of a meridian, it would, in the next year, on its return to the same equinox, intersect, at the equator, the point *N* of another meridian, situated to the west of *M*. It is evident that the point *M* has accomplished its return to the equinox before the sun, and that dating from the moment our luminary and the point *N* had occupied an equal lapse of time in reaching the equinox.

Thus the sun retrogrades to westward in every year. But although this retrogradation be of a little time in each annual revolution, (54 seconds,) small as it is, finally introduces augmentations in the length of the civil year that become considerable by the accumulation of ages, and remove the sun very far from the vernal equinox, so that this luminary must delay hours, and afterwards whole days, in order to return there.

But a fact worthy of remark is that the intersection of the terrestrial equator by the sun, at points situated, from year to year, further and further to the westward, increases progressively the duration of our civil year. Whence it follows that the return of the same equinox cannot be subject to the immutable fixity of a day and month constantly the same.

See the Chart 4, Fig. 1. The sun being at the vernal equinox *E*, intersects at the equator a point such as *M*, of a meridian of the earth.

In the following year, the same meridian *M* comes in the vernal equinox *E*, when has the sun as yet arrived only at the point *R*, so that it requires some time longer to traverse the distance from *R* to *E*. But during this short interval of time, the earth, not ceasing to rotate upon its axis from west to east, brings forward another


Cancer ☋
Gemini ♊

meridian *N*, situated westward of the meridian *M*, that arrives at the vernal equinox *E* simultaneously with the sun, where it is intersected, at the equator, by that luminary.

It is seen, then, that the sun delays, each year, in effecting its return to the equinox *E*. Let us suppose the sun in the vernal equinox, at 0 degree of Aries, intersecting, at the equator, the first meridian of the present secular period; the year will be composed of 360 days.

Further on three thousand years, the sun will have retrograded by 162,000 seconds or 45 degrees; our luminary will be in *X*, 15 degrees of Aquarius, and three days more will be necessary, in order that it may return to the vernal equinox *E*; the year will have 363 days.

Four thousand years afterwards, the sun will have been carried by its retrogradation, to *V*, 15 degrees of Sagittarius, sixty degrees more to westward, and it will require four days more of the sun, that it may accomplish its return to the same equinox *E*; the year will have 367 days.

Five thousand years later, the sun will be, by its retrogradation, in K, 0 degree of Libra, 75 degrees more to westward, and will use five days more in order to return to vernal equinox *E*, and the year will be composed of 372 days.

The star which we have seen in beginning that chapter, as having advanced one degree to the eastward, is one of the consequences of the retrogradation of the sun, which carries this luminary more and more to the westward, against the order of the zodiacal signs. This retrogradation, in accumulating with the number of the years, will become redoubtable by the magnitude of the

disastrous phenomena that it has caused and will cause again. It is to that continual retrogradation, that we must refer the antique devastation of the earth, by a burning heat, concluded by an immense cataclysm, which wasted the earth. This formidable past allows no doubt about the return of similar phenomena, since the cause which brings them, perseveres in its action. It is not, therefore, a study destitute of interest, that to seek in ages yet to come, those in which the same disasters will be brought forward again.

About 5,334 years ago, the sun and the earth met them in the same side of the heavens, (at 0 degree of Aries, vernal equinox,) without ceasing to circulate each one in its own orbit. The sun intersected, at the terrestrial equator, the first meridian *M* of the secular period, in which we are. This proximity of the sun and of the earth, at their maximun, occasioned the most awful disasters in increasing more and more the solar heat on our globe, during several centuries. The temperate zones and the equatorial regions were reduced to have no more, either animals or plants under the long action of a burning sun.

The extreme and constant heat could not persist without acting, at the same time, on the seas which overspread the greatest part of the terrestrial surface. It caused an immense evaporation of a long duration, for all, relative to the powerfulness of the cause. When, in course of time, the sun was removed from the earth by the continuity of its retrogradation, the vapors, heaped up the atmosphere, condensed, and the great waters were precipitated on the earth, under the form of rain, with an excess of fury and greatness, which since has never been equaled. They gave rise to the universal cata-

clysm, known by the name of Noah's deluge. It took place when the sun was in Pisces, at 26 degrees, about 5,050 years ago.

From year to year, the sun intersecting the terrestrial equator, more and more to the westward, lengthens progressively the duration of our civil year, by two days for every sign of the zodiac, all along of which it will have retrograded from the vernal equinox, so that our civil year, which had comprised 360 days, when our luminary was in the vernal equinox, will be composed of 372 days, when the sun, after having retrograded by the signs of the zodiac, Pisces, Aquarius, Capricornus, Sagittarius, Scorpio, will have passed into Libra. The sun afterwards will retrograde from the autumnal equinox, (Libra,) by the signs: Virgo, Leo, Cancer, Gemini, Taurus, till to Aries, and the civil year will diminish progressively of the same quantity of days, with which it will have increased in number; so that, our luminary, in reaching the vernal equinox, the year will have only 360 days, as in the beginning of this secular period.

We have already said that, the stars or suns are subjected to a general movement that carries them from west to east; that, it is because they advance from west to east, that the stars which are the nearest our planetary system, cause our sun, all the planetary bodies and the centre *B*, of the earth's orbit, to describe their annual course by the same direction; but, that the sun was making by itself, our earth to revolve daily around its axis. We repeat that for the better intelligence of what is to follow. So that, it be plainly understood that the earth makes its diurnal rotation around its axis, in the direction which depends on the side, whence the sun acts upon it.

When our luminary will have been carried by its retrogradation to Libra, it will have met, at 180 degrees of Aries, at autumnal equinox and *behind* the earth, the first meridian *M*, which it will have intersected *in front* of the earth, twelve thousand years before at the vernal equinox; so that the right in Aries will become the left in Libra.

See Chart 4, *Fig.* 2. Be the sun *S* in Aries, at 0 degree, intersecting the meridian *M*, twelve thousand years after, the sun *S* 2 being in Libra will intersect the same meridian *M* 2, at 180 degrees from Aries and behind the earth. The situation of the sun *S* 2 will be quite the reverse of what it was, at the vernal equinox, in the beginning of the period. The sun *S* 2, therefore, will act in contrary directions to that it had set in the diurnal rotation of the earth. Our globe will yield to its powerfulness, and instead of revolving around its axis as before, from west to east, it will revolve from east to west.

The very moment, then, in which the sun will retrograde to westward, beyond 0 degree of Libra, its rays will act immediately upon our globe in a contrary direction. The movement of the earth will be slackened, and will decrease progressively in order to cease afterwards, without any disorder, by virtue of what the movements of our planet, are common to all the objects which are on its surface. We can compare the discontinuance of its movement to that of a steamer which slackens more and more before ceasing to move.

Men will witness a celestial phenomenon very curious. When the earth will have stopped, the sun will be seen motionless and fixed at the same point of the heavens, and after that stationary state of some interval of time, just as the earth will resume by little and little a con-

trary movement of rotation, they will see the sun moving again, but rising on the horizon instead of going down. The sun, the planets, the moon, the stars will rise in the west, and will set in the east.

The day, in which that phenomenon will take place, will be the longest of the period. There will be, in that day, two consecutive noons in the countries the meridian of which, the sun will have passed, and two consecutive midnights at the antipodes.

Now the movement excessively slow, but continually progressive of the center B of the earth's orbit, brings our planet nearer to the sun in summer, and withdraws it in winter. Before this tendency reaches its limits, winter will have disappeared. The increasing proximity of the sun in summer, will gradually heighten the temperature of the middle latitudes. They will have for several centuries a continual spring, and after that, the climate of the torrid zone. They will produce abundantly every kind of fruits, either of Europe and of equatorial regions.

But the summers and their days, becoming longer and longer, will render the torrid and temperate zones uninhabitable. We conceive that the sun, after having met the earth, at the autumnal equinox, will be in the same side of the heavens, and that, in summer, this luminary and our globe, in their annual revolutions, will pass together through the signs of Cancer, of Leo and Virgo, at a distance from one another, smaller by all the diameter of the terrestrial orbit; and if we take into consideration that the north hemisphere is inclined towards the Cancer, we will have an idea of the burning heat which will destroy the life in the torrid and the middle zones.

At the same time, a mild temperature will have been substituted for the penetrating cold of the polar regions, where the ground is now frozen to the depth of one hundred feet below the surface. Property of nature, which is preparing, in the silence of those solitudes of snow, the prodigious fertility which they will have, when the rays of a nearer sun, will come to vivify them anew.

It is toward these regions, now icy cold, that emigration will, then, remove from all quarters, as it once rushed before the Mosaic Deluge, toward the south, where the fugitives of our race found safety in the high mountain ranges. The veneration which the Asiatic people professes for the high mountains, explains the recollection of the ancient azilum, preserved by tradition, and consecrated by religious sentiment.

The Mosaic deluge took its rise in the north-west; the next southern deluge will proceed from the south-east to the north-west, in about 6,900 years, when the sun, after having retrograded through the meridional signs, shall stand in 26 degrees of Virgo.

We have already said that the increasing proximity of the sun to the autumnal equinox, will smite with death all the living beings under the torrid and in the temperate zones; that it will dry up the water-courses, will empty the largest rivers, and by its incessant approach, will menace our latitudes with a general conflagration. The waters, it will be, that will save the world. The ocean will be evaporated in mass, in an atmosphere that will extend itself, from day to day, in greater altitudes, by virtue of its expansion by heat. This evaporation will be not accomplished by an instantaneous act, but with a regular order of progression from which na-

ture never departs. These vapors, which will be heaped up in clouds, will be able to intercept the burning action of the solar rays. The rain which is always ready to pour down from the extreme limits of the atmosphere, being continually evaporated afresh, will re-ascend to the uppermost zones, before reaching the lower ones, which the radiation of a blazing soil will render peculiarly apt to generate vapor.

When the continual retrogression of the sun will withdraw it from the earth, these ponderous collections of water, transformed into clouds, will lose a considerable portion of their heat. This lowering of temperature will commence in the upper regions of the atmosphere. The waters that will be the highest up, in descending toward the earth, and passing through the inferior regions, will cool them, and the condensation will become general. The ocean will precipitate itself in its immensity, under the form of rain. It will be a torrent-like descent, accompanied by tempests of unparalleled sublimity. Terrific winds whirling around the earth; conflagrations of lightning, in a state of permanence, tearing in its whole extent a maddened atmosphere. On the surface of the planet, volcanic eruptions, explosions of internal convulsions and earthquakes agitating the crust of the globe, already tossed by the billows of an appalling flood. Murderous phenomena of a tempest matchless in terror! Men will have no words to describe the boundless and universal sweep of its awful ravages.

No element of destruction will be wanting to this grand cataclysm. The impetuous waters, tossing thousands of feet above the continents, will rush headlong over them, sweeping away forests, tearing open valleys,

hollowing out abysses and accumulating ruin and death pell-mell, in their passage.

It will readily be conceived that in this fall of the seas, they will detach from the polar mountains and the glaciers, blocks and bergs of ice of all dimensions, some of which will be many hundred feet in length, breadth and thickness. This fact, established by the testimony of the last cataclysm, admits that sand, rounded pebbles, and enormous fragments of rock, (erratic blocks,) must be caught up with these masses, in the same manner as similar substances are embedded in our modern glaciers. These floating islands of ice will be swept onward by the violence of the current; in some places will be dashed to pieces by their concussion against obstacles that will resist sufficiently to bar the way, such as chains of mountains, and will cover their slopes with fragments, elsewhere crushing the peaks of the less lofty eminences, grinding their salient points away, and furrowing their summits with the spurs of the hard rocks projecting from their bases.

By degrees, as the melting of the ice will go on, the heavy bodies which it will have held fast with it, the sand, the rounded pebbles and the erratic blocks will be abandoned to their own weight, and range themselves in the direction of the currents, on the flanks of the mountains, on the hills, on the table-lands and on the plains.

There is no doubt that the earth has been ravaged by several deluges. However, our globe only presents on its surface the evidence of the two last ones, written thereon in fadeless characters. The current of the most recent one, or the Mosaic deluge, has marked its passage from the north-west to the south-east. The discernible

traces of the other one, which occurred one hundred and twenty centuries earlier, may be recognized on a line that runs from the south-east to the north-west.

On the surface of the earth there are elevations and depressions where the waters tend to flow off; but relatively to the astronomical position of our globe, there is no upper or lower point. The southern hemisphere appears to us to be lower than we are, while to its inhabitants our hemisphere appears to be under their feet.

It is with ease that we can convince ourselves that if the marks of the passage of the Boreal or Mosaic deluge can be plainly traced from the north-west to the south-east, similar marks left by the Austral or Southern deluge, are no less visible from the south-east to the north-west. We have but to reverse the map of the world, so that the south shall be at the top, and the north at the bottom, with the eastern coasts of the Asiatic Continent where the western coasts of the European Continent usually are. This process allows us to perceive, instantly, that the water-chafed shores of the eastern part correspond with the similarly corroded outlines of the western portion, and that they resemble no other. There will be seen a conformity of features jutting out, the same essential depressions, like indentations of the land by the sea, resemblances of form in the configuration of the soil, analogous prolongations of wrecks, sharp and scalloped capes and headlands, turned in a sense coinciding with the direction of the two diluvian currents which, starting from the two opposite extremities of the globe, have left the marks of their passage in two contrary directions.

About fifty-seven centuries later, the sun will be, in winter, at its greatest distance from our hemisphere.

The winters and the nights will be extremely long and cold; the summers and the days of short duration, and by no means warm. The Europe will have a biting climate; the icebergs of the pole will invade even its Southern countries, and yet more the meridional latitudes in the North America.

This period of a bitter cold will be of a long duration; it will terminate as it began, by abundant and continual rains. These will not cease to fall until such time as the sun again approaches by its retrogradation the sign of Aries. The temperate zones will pass again through all the degrees of heat, to the burning climate that will render them uninhabitable. The same disastrous phenomena will be renewed, and another northern deluge, setting out from the north-west toward the south-east, will submerge the earth.

The more or less confused traditions that we possess concerning the antiquity, tend to create the supposition that they go as far back as the migrations caused by the great cataclysms, which have by turns ravaged the earth. But, not any tradition carries us back to the obscure period in which these people began entering into society.

Our time, which is an age of investigation, begins to take off the veil of a past nearly infinite. We would be obliged to go back to hundreds of thousands years in order to re-ascend to the former societies. For, the normal state of the primitive man, was a ghastly savage state. How many series of thousands years, he had passed through that animal life, before to be organized in society, and how much other series of thousands years he had passed before to think of writing his own history which is only an imperceptible part of his true history!

Man has been present at the climacteric and geological evolutions, which have made their work with the help of millions of years. In the ancient alluvions, belonging to the quaternary epoch, there have been taken out fossils and extinguished species of animals, human bones, found with remains of mastodons and rhinoceros, hatchets, points of arrows made with silex, and thousands of specimens of the primitive industry, which bear the indisputable mark of man's hand. In considering the past under that point of view, we are allowed to state, that the community of astronomical ideas among the old nations of the antiquity, must proceed from an anterior antiquity. However, the state of minds to which the origin of that community answers, is not a primordial state.

The Chaldean period of 432,000 years, and the period of 30,000 years which the Egyptians counted from the commencement of Typhon to the death of Osiris, are generally known. The chronologist, to reconcile these enormous accumulations of years with the exigencies of their systems, have some of them, taken each year to mean a day, and others a lunar month. It will be seen by the dissertations to which these periods have given rise, that opinions vary as to their duration. The generally accepted view in our time, fixes the Chaldean period at 432,000 days, and the Egyptian period at 2,424 solar years. In the colleges, a totally different interpretation prevails. There, they are treated as fables, invented by national vanity, to push back beyond reasonable limits, the antiquity of the political existence of Chaldea and Egypt. This explanation refutes itself, if we consider that these long periods are found precisely in the recitals of those races who studied astronomy. The 432,000

years of the Chaldeans, and the 30,000 of the Egyptians are nothing but astronomical formula.

The priests of Chaldea and Egypt, it is known, communicated the real meaning of their scientific formula to the descendants of the sacerdotal families, whom they instructed in the sacred colleges. But, they concealed it studiously from the crowd and from the strangers, or presented their calculations to them only under allegorical forms. This reserve was dictated to them by the policy of self-preservation, because it guaranteed to them, that proud supremacy from which flowed all other advantages.

The Chaldeans related that, during their period of 432,000 years, ten of their kings, of whom the first was Alorus, and the last Xisuthrus, reigned 10,000 years. That Xisuthrus saved himself, his family and the alphabet in a ship when the deluge commenced.

But, before coming to a solution of this problem, the one of a rare simplicity, we would remark that the different periods of the ancient nations, which have practiced the astronomy, are but subdivisions or multiples of the Chaldean period. The Egyptian period of 36,000 years, multiplied by 12, gives 432,000, as the product. The other periods of Egyptians, of 30,000 years multiplied by 14. 4, and of 24,000 years multiplied by 18, reproduce 432,000. The Brahminical period of 1,728,000 years divided by 4, and the other period of 1,296,000 years divided by 3, give the Chaldean period for a quotient. Finally, their period of 864,000 years, is the double of 432,000.

So unanimous an accord between the astronomers of high antiquity, as to the combined movements of the sun and the earth, could not be due to chance.

The method of calculating the number of seconds by which the first terrestrial meridian, at the beginning of the secular period, annually diverges from the centre of the sun, at the vernal equinox, discloses to us the manner in which the ancients turned their formula to account. It is plain they took as the bases of their calculations, the fundamental year of 360 days, and that they added to it quantities of time proportional to the number of seconds by which the meridian had withdrawn from the sun. In this way they had the means of instantly finding the number of seconds by which to express with exactitude the length of the tropical year. Thus, the terrestrial meridian, coinciding with the centre of the sun, at the vernal equinox, diverges from it as follows:

432,000 seconds	in 10,000 years of 360 days.
43,200 seconds	in 1,000 years of 360 days.
4,320 seconds	in 100 years of 360 days.
432 seconds	in 10 years of 360 days.
43.20 seconds	in 1 year of 360 days.

But, the experience of time, having instructed the Egyptians, that these numbers corresponded not exactly with the course of the celestial phenomena, because they were too short, they invented the period of 11,340 years, of which the subdivisions agree better with the movement of the stars along the ecliptic.

The priests disguised that formula beneath lengths of time, intentionally exaggerated, which concealed some circumstances of their own history, and moreover, they expressed it, not with integral but with fractional number, in order to render the sense inexplicable to uninitiated persons.

The fundamental basis of that formula, rests on 54 seconds per year.

54 seconds	in 1 year.
540 seconds	in 10 years.
5,400 seconds	in 100 years.
54,000 seconds	in 1,000 years.
540,000 seconds	in 10,000 years.
612,360 seconds (or 170 deg. 6 min.) .	in 11,340 years.

CHAPTER IV.

THE MOON.

THE moon does not revolve around the earth, as the modern astronomy says; because if it was so, the eclipses of the sun would begin by the oriental part of that luminary, and end to the west; absolutely the contrary of what is observed.

But, the moon accompanies the earth, from west to east, in her annual revolution. Her apogee and perigee take place indifferently when she is new, full, or in her quarters.

Apogee signifies the point of the moon's orbit the farthest from the earth; and perigee the point of the moon's orbit nearest the earth.

At the *summer solstice*, the moon may be at perigee, when she is new, and at apogee when she is full.

At the winter solstice, she may be at apogee, when she is new, and at perigee when she is full.

From this regulation may be deduced the general characteristics of the whole plan: that, the moon, in her movement of annual translation, makes excursions on each side of the terrestrial orbit; that, these excursions are included within two circular limits, concentric with the centre of her orbit, and beyond which she never passes; that, the orbit of the earth being eccentric to these two circular limits, our vision may allow itself to

be surprised by deceptive perspectives, and thereby assign to the movements of the moon, which are constantly uniform, and always in the plane of the ecliptic, inequalities that do not exist; in fine, may subordinate the judgment to the errors of a system of false appearances.

SEE CHART 5. *A* is the centre of the planetary system; *B* the centre of the earth's orbit, and *C* the centre of the orbit of the moon.

The centre *C* of the moon's orbit, is not fixed; it describes around the planetary centre *A*, the small circle *C D E* and *C*, which it completes, at the same time that the centre *B* of the terrestrial orbit accomplishes its revolution around the planetary centre *A*.

The interior dotted circle *WWWW* designates the limits attained by the moon, when she is new, or nearly so, or shortly after she has been so.

The external dotted circle *XXXX* indicates the limits reached by the moon when she is full, or nearly so, or shortly after she has been so.

These two dotted circles are parallel, and have the point *C* for a common centre.

This centre *C* cannot coincide with the centre *B* of the terrestrial orbit, because the moon is sometimes nearer and sometimes farther from the earth.

Neither can the centre *C* coincide with the planetary centre *A*, because the order of the phenomena would be reversed. For, the moon being full, at the summer solstice, instead of being at apogee, would be at perigee, and so near the earth, as to shut out the heavens from our view; and again, in being full, at the winter solstice, instead of being at perigee, she would be at apogee, and would go beyond her limits, to a considerable distance

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from the earth, and cause us to behold her with a diameter much smaller than the one now visible to us.

The eccentric circle *EO EO EO* represents the orbit of the earth; it intersects unequally the track of the excursions, made by the moon, on each side of it. The track of the excursions made by the moon, is indicated by the letters *MMM.*

At the summer solstice, the sun *S*1 is in the sign of Cancer, the earth *P* in the sign of Capricornus, or very near, and the moon *N* is full and at apogee.

At the winter solstice, the sun *S*2 is in the sign of Capricornus, and facing the earth *P*2 and the moon *N*2 which is new and at apogee.

Now, since we have traveled over a large portion of the earth's surface, we are acquainted with the fact, that the north and south poles have alternately, a day and a night of six months' duration; and that, when the sun lightens one of the poles, the moon shines over the one, which would remain, otherwise into a complete obscurity. In this manner the inhabitants of our planet, never suffer from the total absence of the radiations of our two great luminaries. These results are indebted to the inclination of the terrestrial axis.

See Chart 3. *Fig.* 1. *EE* is the line of the plane of the ecliptic, seen sideways. The sun *S* is in the sign of Cancer, at the summer solstice; its rays *RR* shed their light upon the north pole *N* of the earth, and leave the south pole *M* in obscurity. The moon *L* shines upon the south pole *M*, and remains invisible to the inhabitants of the north pole *N*, as can be seen by examining the dotted lines *PP*. This figure represents also the summer of the northern and the winter of the southern hemisphere.

Fig. 2. *EE* is the line of the plane of the ecliptic seen sideways. The sun *S* is in the sign of Capricornus, at the winter solstice. Its rays *RR* lighten the south pole *M*, and leave the north pole *N* in obscurity. The moon *L* sends her rays *PP*, upon the north pole *N*, and cannot be seen by the inhabitants of the south pole *M*. This figure represents the winter of the northern and the summer of the southern hemisphere.

Another source of illusions, to which we persistently revert, is the inclination of the earth's axis upon the plan of its orbit. It is well understood that in consequence of this inclination, our northern hemisphere is inclined toward the sign of Cancer and that, on the opposite side, the southern hemisphere is inclined toward the sign of Capricornus. Still, the knowledge of this fact does not prevent from continuing to place the true north of the planetary system, very near the polar star, which is situated not far from the direction of the end of the earth's axis, which passes through the Arctic Pole, and that this axis points towards a region other than the true north.

In order to determine the place of the true north, it would be necessary to mentally erect the earth's axis perpendicularly on the plane of the ecliptic, to displace the earth and carry her far from her orbit, in such manner, as to place her axis on the centre of the planetary system. Nothing can be more decisive than this conclusion, since it is a geometrical consequence of the locality of the earth and of the position of her axis. Thus, contrary to the generally received opinion, the polar star is remote from the north and does not indicate it.

CHAPTER V.

SKETCH OF THE UNIVERSE.

All the spheres in the universe, are linked together by unlimited connecting influences. Although it may not appear likely, that science will ever be able to embrace the whole of that awful immensity, still, some culminating points may serve it for resting-places, on the way, by the aid of which to penetrate into the nearest regions of this inextricable infinite. But, this will be on condition that we divest ourselves of every idea of size and distance, and become thoroughly imbued with the reflection, that the mechanism of infinity recognizes nothing but proportions. A luminary which is situated at hundreds of thousands of leagues from us, overwhelms our mind with the bare statement of its distance, because we compare this remoteness with the data that surround ourselves. We rarely think of laying aside this irrational habit, which imposes such arbitrary conclusions upon us, through the sensations that we receive from our manner of viewing the largeness, the smallness, the nearness and the distance of things.

The arrangement of the spheres is subjected to the mathematical laws of an unique plan, determined by a physical system, that is essentially universal. The law that governs our planetary world, is indicated by analogy in the other regions of the heavens. Every thing is

there forcibly brought under a common discipline. Nature, far from being subdued by the innumerable diversities which she comprises, subjects them on the contrary, to yield to her government, with so absolute a firmness, which she exercises strictly on the largest of worlds as well as on the grain of sand. She never runs a risk. She knows so well how to ally her prodigious fecundity to the requirements of every destination; she throws such a variety into all the forms, she fashions, and disposes them with such a delicacy of adjustment, the proportions are matched with so imperceptible shades, and the more salient touches of true harmony; she excels to conjoin the portions with firm and tenuous bands, and with the help of time, to make them concur to the unity by a regular and sure action, that if the spirit of investigation has not reached the general cause of her works, an attentive meditation fails not of discovering to us, a plan realized with an incomparable art, which strikes the understanding by the infinite of its combinations as much as surpasses it by the transcendency of its simplicity.

That whitish glimmer of irregular form which makes the turn of our heavens, is known by the name of milky way, and more generally by the popular name of Saint James way. Its milky appearance is caused by compact masses of stars, the light of which reaches us, destitute of its brightness on account of their enormous distance. All the stars that we see on this side of its limits, and our planetary system, belong to this prodigious agglomeration of celestial bodies. The sun, the earth, the other planets, and the satellites are situated near its centre.

It is said, too, that the diameter of our sun is nearly

four times larger than the distance from the earth to the moon, that is, about 315,000 leagues. But, the milky way includes more considerable stars. For, they cite the star Sirius, as a sun 2,688 times larger than our own.

One thousand millions of planetary systems may be accorded to that galaxy, in which we are included. The stars or suns seem to lie close together, on account of the incalculable distance where they are from us. But, in that case, analogy leads us to conclude that these suns must be separated from each other, by distances as great as that which separates our sun from the nearest star. These measureless deserts, placed as so many barriers between all planetary systems, are a physical necessity to secure their geometric independence.

The one thousand millions of suns that our galaxy seems to comprise in its domain, light probably fifty thousand to eighty thousand millions of planets or earths, among which, considerably larger than ours ought to be. Each of these worlds must have its specialties, its lands, its sky, its sceneries, its millions of inhabitants. These are probabilities which we offer to the critical judgment.

We know that, in the universe, our galaxy is not one alone of its specie, and that there are other galaxies, the number of which increases at each improvement of the telescope. To whatever height, to whatever depth, we may bear our investigations, everywhere myriads of galaxies overspread deep abysses with their lights. But, even these prodigious transcendencies which completely abash our intellects by the magnitude of their dimensions and the multiplicity of their number, dwindle in contrast with the still sublimer grandeurs placed beyond.

They become smaller and smaller as we advance, and are lost, at last, by their own diminutiveness, in the same manner, as the formidable structures that succeed and surpass them, disappear in the presence of the still more surprising regions, which the continuity of the universe unfolds to us.

All these vitalities of light and motion, which the most amazing number cannot represent, are linked, in still more distant regions, to vertices of suns that open to us new fields, where life has ever other surprises in reserve for us. We should grow weary of pointing out the splendors of nature long before she ceased to exhibit them. Her fecundity has no limits.

Borne in spirit along with this appalling current, we contemplate the evolution of a cycle rolling away upon accumulations of cycles, the duration of which paralyzes all our resources of measurement, even those that are approximative with the number of its incalculable periods. Let us not attempt to record beyond this limit the number of the culminating year of the universe. We look around for that number in vain; it is nowhere to be found. This lapse of duration which moves us so profoundly, contrasted with the eternity assigned to the existence of worlds, is but the sound of the clock that dies away with the parting hour. The thousands millions of centuries are not wanting to time, and the thousands millions of worlds are not wanting to the universe.

Shall we presume to have recourse to the magnifying power of our instruments, in order to keep pace with infinity? Were we to make our telescopes magnify millions of times more than those already at our disposal, what should we discover when we scanned the heavens with them? Further aggregations of suns, forming an

immense vault of scintillating fires above our heads, which the visual ray cannot penetrate. And, although abysses of darkness, hundreds of millions of leagues in extent, separate these suns from each other, their perspective would still be hidden from our view by the accumulation of the celestial splendors.

There, in the presence of these firmaments ablaze with light, no apparatus however perfect, intended to assist human vision, could pursue the course of our investigations. There the impassable barrier that closes against us the channels of the universe, would confront us. But, the confines of the heavens are not there.

Thought and speech, too limited in their resources, absolutely fail in the endeavor to enunciate such incommensurability. We cannot get even an inkling of it, by the aid of time and space. To overburden the mind with accumulated calculations of time and space would still be to lay down limits for what has none, by adding duration to duration, and wasteness to wasteness. Let us suppose as many more suns and worlds as we have already accumulated; let us make the heavens not one thousand million times, but thousands millions of millions of times, larger; let us then unlimitedly heap multiplication upon multiplication, so long as our intellectual strength will permit, away beyond this unimaginable expanse, the universe continues, limitless and immeasurable.

Let him who will invent enormous immensities that put to shame, exaggeration itself. Vain attempt in those regions, where neither centre nor circumference, neither numerical quantities nor gradations of time survive. It would be to play the part of the tiny worm which, having succeeded in creeping up the humble

smallness of a blade of grass, would cast it into the scales against the mass of worlds. For, here, hyperbole the most extravagant, the number the most astounding, fall far below reality. These fathomless abysses, whose mysterious appurtenances are concealed from us, do not form a sensible point in that infinity, where the profoundest meditations and the science of all generations have been and will be ingulfed.

In presence of the revelations of this inexhaustible geometry, which throws into the shade our abstrusest mathematics, man, led back to the consciousness of his diminutive proportions, is surprised to find himself disenchanted of all his conceits. We ought to have already given utterance to our reflections relating to this infirmity of our race, which is of so old a date in our history, and which ascends from the peasant to the king, gathering volume as it rises. Such is our profound ignorance of the things of nature, that we have concluded to look upon ourselves with the eyes of an exclusive admiration, because we have always failed to imagine, in painting or in sculpture, a type superior to the human form.

The universe reveals the most sublime reality which might be felt by man, who belongs by its intellectual culture, to this very small minority, which forms the world of the thought. It is athwart the Stellar regions, which require an eternity for their exploration, that his mind in the plenitude of its knowledge, abandons itself, in order that it may become inspired with the elements of a profounder science. To his enlightened understanding it belongs to take in and to reproduce, from the union of the supremely great and of the supremely beautiful, those living emotions, whose charm is continually

prolonged in the play of a geometrical perfection solemnly instinct with life. Flood of vitalities and activities; fecundity, richness, variability, endless swarming forth of illuminations; motion everywhere, and everywhere the novelty that it perpetuates. Mighty features these, broadly stamped upon the physiognomy of the universal reality, with all the hum of life, the harmonies of luminous hue. On this stupendous page of eternity, in which nature opens the perspectives of her grandeur, each sun is a letter of the name which designates her with her attributes, and that name, infinity can utter it, only by the unanimous concert of the sublimities of the universe. Each one of the illuminated characters of this scintillating topography of the empyrean, has been marshalled by the infallible science of nature, and the transformations which have improved them are the continuance of her work, set with indelible stamps in her archives. Nowhere the law of progress is so visible. Magnificent demonstration this, of her powerfulness that, in its infinite, embraces, possesses and masters all things. How sublime her incomparable industry is it that, in the eloquent simplicity of its art, has employed but one substance, in order to introduce into the deserts of space, all the diversities of the existence; colors, brightness, evolutions of moving architectures, each one with the regulations of its mathematical preciseness, the speciality of its inhabitants, intelligences unknown to us, under forms likewise unknown.

All these residences of dissimilar populations, isolated one from another by prodigious distances, are the diversified institutions of an unity, which commences and ends in not any part. And always the infinite in its persisting reality, which, making our thought overleap

the barrier where our senses encounter their limits of perception, puts it in front of the enormities of the heavens, and in front of the most reduced diminutivenesses of earth; two opposed contrasts by the state of existence, the form and the dimension, in front of the invisible spheres that circle beyond the ken of our telescopes in the impenetrable depths of other celestial regions, and on earth, in front of the invisibilities that move beyond the reach of our microscopic instruments.

A substance this, primordial, unique and infinite. The origin of all that is, and, at the same time, the universal mathematical law, preordained for the government of space, matter, life and motion; susceptible of exercising the most delicate functions, even those that are imperceptible to our instruments, and capable, in the limitless application of its forces, of carrying back the spheres to their original conflagration; passing, by insensible transitions, from the most elementary simplicity to the most complex transcendency, preparing slowly, through the long lapse of centuries, the marble of our palaces, and furrowing the clouds with flashes of light, with an art of suddenness that cannot be equaled; producing contrasts the most varied, and yet itself remaining invariable; which never annihilates, but balances life and death in mutual dependence, and pursues the imperturbable course of its transfigurations; which causes the motion of the worlds to spring from the tendency of caloric to find an equilibrium, and permanently maintains the same by the spherical form of those worlds; which draws from its state of equilibrium the force that mutually repels the spheres, and thereby renders it impossible for them to clash in space; which has foresight for its logic; conformity for its method of ar-

rangement; fecundity for its object; activity for its means; economy for its measure; progress for its conclusion; in fine, whose industry is an abyss of simplicity, and whose disposable element is always the same. For, one single substance, spread throughout the universe, is its origin, its law and its preservation. (*)

We halt here, at the preface of the grand book of the Universe, which contains all what is real and possible.

(*) It is now acquired by science that our sun drew its origin from the transformations of the nebulæ, and that all the realities existing upon the earth in the state in which we see them, man, animal, vegetable, mineral, take their rise from the transformations of the sun, from which that luminary fetched, then, the elements of life. That period has lasted millions of millenaries. Uncalculable series of centuries have been necessary to the formation of the different living organizations, and to the physical formation of man, in order to make him arrive at having the body he possesses, and consequently, at being the species he represents. The course that the progress of his organization ran, has been imperceptible. Not any organ in man is now finished. Every living type is in a continual improvement through the ages, which is done by a slow and obscure progression, without any other intervention than the infinity of time. The order of the phenomena in nature, is ordinary and non-extraordinary.

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